# Herefordshire Fungus Survey Group

# News Sheet Nº 24: Autumn 2012

*Cheilymenia vitellina – The Weir, 11/7/12*

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| **President:** | Ted Blackwell |
| **Recorder:** | Jo Weightman |
| **Chairman:** | Roger Evans |
| **Secretary:** | Mike Stroud |
| **Treasurer:** | Margaret Hawkins |

**Welcome to the Autumn 2012 News Sheet**

Well…! It has really been one of the strangest of years, right from the start!

How much the dearth of fungi has been due to the climate and how much due to the almost continuous 'Slugfeste', which is in evidence in our vegetable gardens (cropping off seedlings as they appear), is anyone's guess. However, this is reflected in a rather shorter Recorder's Report than normal in this issue. The quality of the articles, though, is first rate - thanks, as always to our contributors.

Ted Blackwell, with his usual erudition and interest in poking around in the less well-known areas of mycology, treats us to two fascinating pieces:

- one on de Bary bubbles, with a couple of smashing photographs by Bryan Lack;
- the other, inspired by John Bingham's equally beautiful photograph of a 'mould' on a Ground Beetle, explores the various anamorphs of some of the *Cordyceps* species.

Debbie Evans, self-confessed rustaholic, tells us about more of the rusts we should be looking out for in our gardens - and others' also! This article (in a slightly different form) first appeared in, and is with the kind permission of the editor of the "Friends of Treborth Botanic Garden Newsletter".

And Jo Weightman discusses the difficulties associated with identification of species, in that tricky area where pores and gills seem to be neither one thing nor another.

I am sure that you will find that all of these articles will prove to be really interesting reading.

Whilst on the subject of Jo Weightman, our Recorder: as most of you will know, she has now moved down to Orleton permanently and so her new contact details are

1 Eagle Cottages, Church Lane, Orleton, Nr.Ludlow, Shropshire; SY8 4HT
**Tel.** 01568 780329
**e-mail:** jo.weightman@gmail.com

I am sure that you will join me in wishing her well and all happiness for the future down here.

There is often discussion about the problem in identifying what particular wood a specimen is growing on and, in the past, Ted Blackwell has run a very good workshop including this. Recently, he copied this e-mail to me, which may be of interest:

"….. when talking about wood identification I recommended an inexpensive booklet* which identifies tree species from the arrangement of twig buds which is equally applicable to identifying fallen twigs and branches.

Also for winter or bare twig identification, there is a very helpful web site http://www-saps.plantsci.cam.ac.uk/trees/index.htm .

This is equally helpful for ID-ing British trees in leaf."

* 'A guide to the identification of deciduous broad-leaved trees and shrubs in winter', by Andrew May and Jonathan Panter. A Field Studies Council Guide, reprinted from ***Field Studies*** **Vol. 9 (2000).**

You can order a copy of this booklet from: http://www.field-studies-council.org/publications/pubs/a-guide-to-the-identification-of-deciduous-broad-leaved-trees-and-shrubs-in-winter.aspx

Alternatively, by the time you read this, I shall have a limited stock available to HFSG members, at the same price (£5.50 each), which you can purchase from me when we next meet.

In the last News Sheet, I stated:

"By the time of the next HFSG News Sheet (Autumn 2012), we shall, hopefully, have our own HFSG Website, with this and much more information about the Group…."

Unfortunately, this is not yet so but, thanks to Les Hughes' work on the project, we are nearly able to put up a version for people to have a look at.

In the meantime, this and many other of our recent News Sheets (as well as the 2012 Foray Programme) are still available on a part of the BMS website at

www.britmycolsoc.org.uk/mycology/recording-network/groups/herefordshire-fg/

Don't forget that the Editor is always looking for ***your*** contribution(s) to the News Sheet and the deadline for the next issue is March 20th. I shall do my best to send it out it expeditiously, but it does help if you can send me your articles, photos, etc. as far as possible in advance of the deadline!

Happy reading!

Mike Stroud
e-mail: mikestroud1@btinternet.com

**RECORDER'S REPORT JANUARY – AUGUST 2012**

Jo Weightman, Recorder

It was a testing half year for fungi and humans alike – what would be the effect on mycelia of a mild spring-like January fooling garden plants into an unseasonable spurt, killing cold early in Feb, drought conditions by April, cool and very wet weather lasting through to July?

Conditions clearly suited *Taphrina pruni* as pocket plums were conspicuous in many a blackthorn thicket. Thank you to those members who responded to my appeal for news of this species. St George`s Mushroom, *Calocybe gambosa,* was abundant in the SE, appearing in large rings and in places where it had not been seen before. However, I have not received news of a similar frequency in Herefordshire – only one record in fact from the Bogmarsh foray. Waxcaps and *Agaricus* spp. were locally abundant in the SE in May – but again not in Herefordshire, where just two of the latter were recorded, *A. silvaticus* and *A. bisporus*.

The excessive wet could well have triggered a good 'mouldy growth' on dead wood and rotting vegetation, but this did not materialise. July and August should have been great for mycorrhizal species, since trees have at last had plenty of water. However, although green growth has been phenomenal, it has not been matched by outstanding fungal growth. In this, Herefordshire does not seem to have been alone. Conditions did favour *Ramaria formosa* which was at its (very occasional) best in Fishpool Valley on the 21st August and *Lycoperdon echinatum* a few days later. These two usually fruit well when other fungi are also abundant, not in isolation. Similarly, a walk through the Mortimer Forest on the 22nd yielded nothing until, in one small area I saw *Ramaria abietina* (K) and *Volvariella murinella* (2nd VC36 record, K).

Note: Herb. K . ≡ Herbarium at Kew

**Numbers**

415 new records overall to end of August; 143 new site records (foray data)

**Haffield Estate March 28th**

No agarics were seen, but there were a number of common other basidiosmycetes. The most interesting finds were among the ascos, notably *Aporhytima urtica* in its *Apomelasmia* conidial state, which has been deposited in Herb.K. An occasional spring asco, *Disciotis venosa,* a palm-sized wrinkled and veined saucer, smelling convincingly of bleach when broken, was recorded in the vegetable garden.

*Disciotis venosa – Haffield Estate (28/3/12)*

**Bromyard Downs April 18th**

The foray was mainly conducted over the grassland and scrub above the main car park and a brief period was spent in some woodland. The only agarics found were *Panaeolus fimicola* in the grass and *Pleurotus ostreatus* on fallen ash in the woodland. More than half the records were new to the site, the most notable being *Pyrenochaeta fallax* on dead nettle stems and sycamore sooty bark disease *Cryptostroma corticale* on a fallen branch, both deposited at Kew

.

**Widow`s Wood, Bogmarsh May 23rd**

This was the first Group visit to this site, which is currently being converted back to broadleaf after a period as conifer plantation. Most of the records were from the relic broadleaf fringes, others from conifer litter and dead wood. Of the larger fungi, the most interesting was *Clitocybe vermicularis*, a spring species with very small spores and white rhizomorphs, found in conifer litter. *Megacollybia platyphylla* was seen several times, along with a number of other common dead wood or litter agarics. Among the ascos, *Discostroma tostum*, a common spp with few local records, *Sydowiella fenestrans* (1st VC36 record) and *Nectria pseudopeziza* (3rd VC36 record) were of note.

**Upper Lugg Meadow & Baynton Wood Jun 13th**

Only the second Group visit. The grass was uncut in the Meadows, so most records here were of rusts and a powdery mildew on the grasses. In Baynton Wood, where there is much secondary scrub woodland, a number of species were recorded on blackthorn *Prunus spinosa*, including pocket plum, *Taphrina pruni*, the brown rot of fruit *Monilinia laxa* and *Melanomma fuscidulum* (1st VC 36 record). *Phellinus pomaceus* a rock-hard bracket associated with members of the Rosaceae was present on an overgrown hawthorn. *Hydropus subalpinus* a rarely recorded species nationally but a 5th VC36 collection has been deposited at Herb.K as has *Ceramothyrium europaeum* which was identified by Alick Henrici as one of the fungi present in the mat of sooty mould on ivy leaves.

**The Weir July 11th**

Mycorrhizal fungi appear on the list but in no great diversity, one bolete, *Boletus erythropus* one Lactarius, *Lactarius fulvissimus* and one Cortinarius (un-named) and no Amanitas or Russulas. It is significant that *Inocybe godeyi* was recorded as it also appeared in Kent the same week (locally and untypically in huge numbers) so it seems that the freak seasons have favoured it. Dead herbaceous stems accounted for a number of records including *Mollisia coerulans* on hemp agrimony *Eupatorium cannabinum* (VC36 1st), *Dendryphion comosum* on nettle *Urtica dioica* (4th) while *Cheilymenia vitellina* (5th) occurred on bare ground – see front cover for photograph .

**Moccas Park NNR August 8th**
Fungi were less prolific than expected, especially the mycorrhizals of which the best was *Amanita franchetii*. Of the litter saprophytes, *Collybia* cf *aquosa* and *C. ocior*, both uncommon species, have been deposited in Herb K. A very young *Volvariella bombycina* was found on the same tree as in 2011and the nationally rare and protected bracket fungus *Piptoporus quercinus* was fruiting splendidly at a new station.

**NOTABLE NON-FORAY RECORDS**
*Cf Cladosporium* sp. on moribund frond of scaly male fern *Dryopteris affinis* Mortimer Forest 16.04.12 coll. JW, det..EB, and referred to B. Spooner and E. Punithalingam. An interesting find, may be a new species, may not be a *Cladosporium* but may be a new genus. Entered at K as *Cladosporium*.

*Dendryphiella vinosa* on dead stem of *Arctium* sp. Court Farm Kenchester 12.06.2012, coll.& det. Shelly Stroud. 1st VC36 record. Rarely recorded.

*Diderma umbilicatum var umbilicatum* under *Ilex* nr Hanway Common 25.01.12, coll. JW det. EB. 4th VC36 record. K.

*Entyloma ranunculi-repentis* on living leaves of goldilocks *Ranunculus auricomus* Holywell Dingle 19.04.2012, coll. JW det Mariko Parslow. Ist VC36 record. Appears to be nationally rare.

*Exobasidium rhododendri* on Azalea Upper Bacton 10.06.12, coll. Susan and Charles Hunter. 1st VC36 record. Rarely recorded nationally.

*Geastrum striatum* in flowerpot in garden, Upper Bacton 10.06.12, coll. Susan and Charles Hunter.

*Lachnella villosa* on dead stem of nettle *Urtica dioica* Court Farm Kenchester, coll. Shelly Stroud det. EB. K. 5th VC record.

*Marasmiellus vaillantii* garden Bodenham Moor 11.07.12 coll. Margaret Hawkins.

*Monacrosporium subtile* on *Lachnum nidulum* Court Farm Kenchester 12.06.2012, coll.& det. Shelly Stroud. 1st VC36 site. Very rarely recorded.

*Morchella esculenta* in orchard in garden May 2012, coll.& det. Steve Rolph. Also in garden Margaret Hawkins May 2012.

*Mycenella salicina* in grass Bircher Common 25.08.2012, coll. JW det. G. Kibby & A. Henrici. 1st VC36 record for a nationally rare, Red Data listed sp. K.

*Ramaria abietina* (formerly *R. ochraceovirens*) in litter of Douglas fir *Pseudotsuga menziesii* Mortimer Forest 23.08.2012, coll.&det.Jo Weightman.

*Sawadea tulasnei* on living leaves of *Acer platanoides* Lion Yard, Leominster 04.08.12, coll.& det. EB. K. 2nd VC36 record.

*Stictis stellata* on dead stem *Epilobium* sp. Court Farm Kenchester 12.06.2012, coll.& det. Shelly Stroud.3rd VC36 site.


*Volvariella murinella* in litter of Douglas fir *Pseudotsuga menziesii* Mortimer Forest 23.08.2012, coll.& det. Jo Weightman.2nd VC36 site.

Mike and Shelly Stroud and Jo Weightman responded to an invitation from William Watson who is studying relict glacial ponds to join him on a visit to Court Farm, Kenchester on 12.06.2012. 39 fungal species were recorded including *Urceolella crispula,* a fifth record in Herefordshire of a species which is rarely recorded nationally.

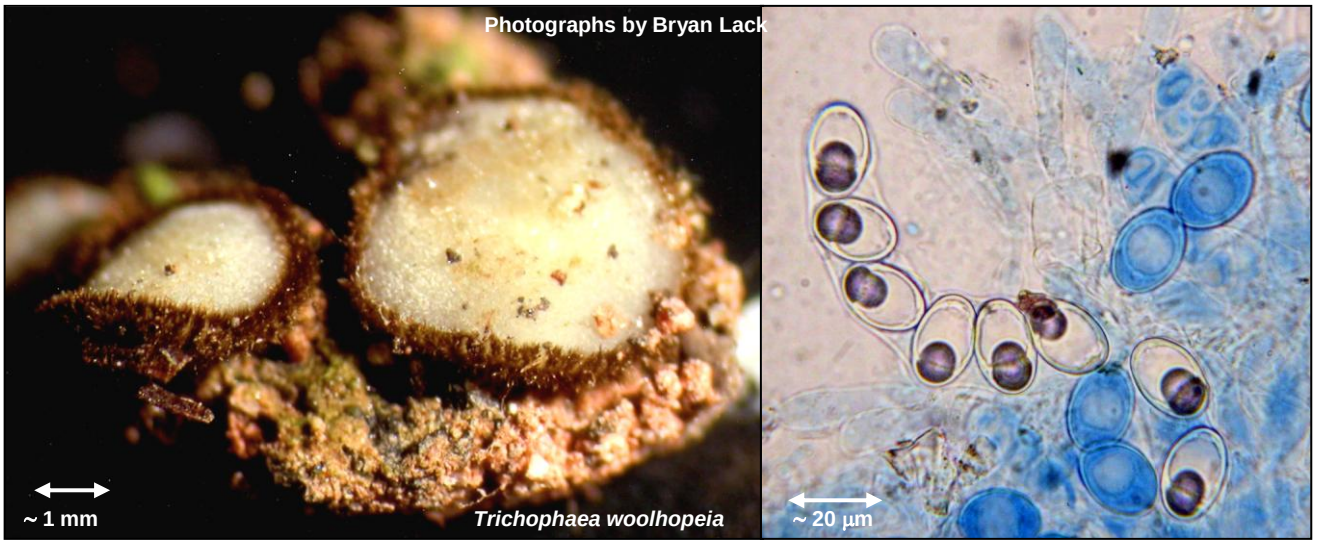

A big thank you to everyone who sends records and especially I thank Shelly Stroud and Ted Blackwell, who spend many hours identifying specimens. To them we are especially indebted for most of our records of microsopic fungi.

And finally, a reminder to dry and keep voucher specimens for the Herbarium at Kew (Herb. K). If uncertain about status, look up your collection on line on the FRDBI which is freely available to everyone. Contact Jo Weightman if you do not know how to do this.

## A BURBLE ON BUBBLES

Ted Blackwell

A small cup fungus *Trichophaea woolhopeia* was found on soil and/or rabbit-droppings at the Humber Marsh foray in August 2009. The Herefordshire provenance of its species name will be obvious to locals, as it was first described by 'fungologists' of the Woolhope Club in 1877 from a type specimen collected at Downton. Its generic name *Trichophaea* means 'dark hairs', an appropriate reference to the outer surface of the cup clothed in bark brown hairs (see left photo below). There are about five other records of it in Herefordshire.




One of the characteristics of this fungus mentioned in technical descriptions is the presence of 'de Bary bubbles', seldom seen in other cup fungi. These are gas bubbles within its spores, which seem to be present instead of the more-usual oil-droplet guttules (see right photo above).

When this specimen was examined microscopically a proportion of the spores were seen to contain dB bubbles. In preparing the microscope-slide the specimen had been stained with Lactophenol Cotton Blue, and it was noticed that some of the spores had not taken-up the stain and remained colourless. It was then noticed that the colourless spores were the dB bubble spores.

These bubbles were first described in 1866 by a Berlin professor, Anton de Bary (1831-1887). He has been hailed as a pioneer of modern scientific mycology and the father of plant pathology. By all accounts was a remarkable man and a brilliant scientist. His sociability and personal charm, coupled with a ready wit, further enhanced his reputation as a leading researcher and teacher, which attracted scientists to flock to his lectures from home and abroad.

Among his many insights, he elucidated the symbiotic nature of the coexistence of fungi and algae in lichens. He made the discovery of the complex developmental cycles and heteroecism of several rust fungi, showing that a rust fungus on Alpine spruce was merely the early stage of the same fungus on *Rhododendron*.

Nearer to home, in 1875 when Worthington G. Smith (a prominent member of the Woolhope Club and renowned for his humorous cartoons) claimed to have at last found the previously undiscovered resting spores (oospores) of the Potato Blight (*Peronospora infestans*), it was de Bary who was able to show that what Smith had described was a totally different fungus - a species of *Pythium*, much to Smith's chagrin.

De Bary observed that when the cytoplasm (the jelly-like contents) of thin-walled ascospores dries out, the weak walls deform and tend to collapse into a boat-shape. On the other hand, thick-walled ascospores of certain species either maintain their shape, or change very little but, as the cytoplasm loses water, a gas bubble appears inside the spore. Although de Bary referred to these as gas bubbles, more recently our own Professor Terence Ingold (twice BMS President and discoverer of Aquatic Hyphomycetes - now eponymously Ingoldian Fungi) considered them to be water vapour.

Although de Bary further observed that bubbles can also form if the water-saturated spore is exposed to the influence of reagents like alcohol, glycerine or sulphuric acid, a considerable search of the literature and consultation with others has not revealed why 'bubbled spores' should resist Cotton Blue stain, while other tissues and 'unbubbled' spores appear to stain readily. This might suggest the chemistry of the unstained dB bubble spores differs in some way from those taking-up the stain or, perhaps more likely, water moving out of the spore under osmotic pressure prevents the stain taking effect.

My warm thanks to Bryan Lack for supplying excellent illustrations of the fruit body and bubbled spores.

Ref:

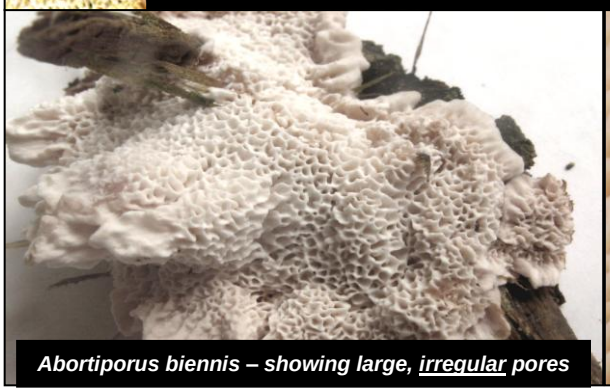
C.T. Ingold. 1950. *A gas phase in viable fungal spores*. *Nature* 177. 1242-43.

**VARIATIONS ON A THEME - PORES ARE PORES AND GILLS ARE GILLS – OR ARE THEY?**

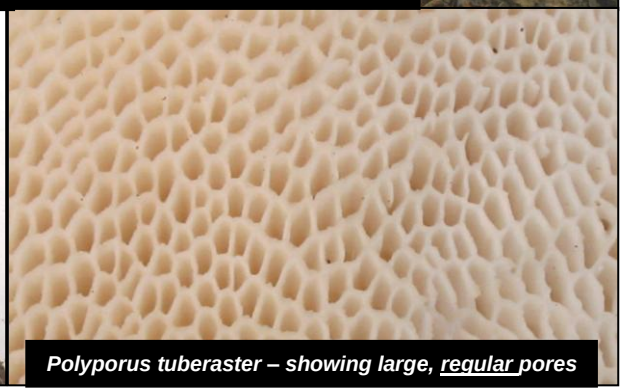
Jo Weightman

When we were young and green, there were pores (round) and there were gills. But the more we look at fungi, the less this simple division works and the sands shift.

*Daedaleopsis confragosa (left) & var. tricolor – showing lamellate structure (right)*



*Abortiporus biennis – showing large, irregular pores*



*Polyporus tuberaster – showing large, regular pores*

**Change with age**

*Trametes versicolor* is a common, well known fungus. The pores are neatly defined and round when this bracket is young and fresh, but become distinctly stretched in age. At the outer edge, as the pore walls break down/tear, the hymenium begins to look distinctly labyrinthine or, in another word, daedalioid. This odd word prompts two other examples.

The Blushing Bracket, *Daedaleopsis confragosa,* has virtually round pores in youth (left inset), yet by the time winter is upon us they have become clearly maze-like (right inset), prompting tales of Daedalus and the dread minotaur. And yet … occasionally one chances upon an example in which the 'pores' are so very stretched as to bear no resemblance to a pore, having instead every appearance of a gill – and this phenomenon occurs from the word "go", even in young material. This curiosity, which favours wild cherry *Prunus avium* and beech *Fagus sylvatica*, has been treated as both a form and a variety:

hence, *D. confragosa* f. *tricolor*

and *D. confragosa* var. *tricolor*.

It has also been raised to a species as *D. tricolor*.

However, CBIB lists only *Daedaleopsis confragosa*, ignoring this apparently distinct manifestation altogether. The cap of 'ordinary' blushing bracket often has reddish patches – the lamellate form/variety/whatever in my (limited) experience, is a good wine-red all over.

**Variation arising from circumstance**

Another bracket with a range of pore shapes - this time probably depending on its position on the host (and not necessarily an age-related development) - is *Abortiporus* (formerly *Heteroporus*) *biennis,*the first and current generic name suggesting that the pore can have an irregular, ie aborted, appearance: the second indicates the variability of the pore shape. This species is also likely to redden where handled.

*Datronia mollis* is a further example of a species with pores that vary, from the beginning, from roundish to elongate and irregular - the influencing factor again probably being the point of attachment on the host log. As the bracket adjusts itself to the configuration of its host, so the pores would be pulled this way and that. A single bracket can exhibit a range of pore shapes, including patches that are strikingly regular. If fresh, the usually narrow black pileus contrasts strongly with the white hymenium, although this will go brown on handling.

When the stresses of position and growth are considered, it is amazing that the great majority of poroid species are so remarkably regular and unchanging, none more so than the stunning and large-pored *Polyporus tuberaster*.

In other instances the word, "pore" is not appropriate, for the edges of the sporing structure resemble folds, being too thick and the 'hole' too shallow. In such cases a descriptive term such as tripe-like, or a more scientific one, such as merulioid applies. The very common *Byssomerulius corium* is a case in point. In *Plicatura crispa*, (not yet recorded in Herefordshire) the crumpling of the hymenium beneath is distinct but more random. This

species forms rows and tiers of small, tan brackets hanging from a narrow point of attachment on fallen braches of broadleaf.

*Craterellus sinuosus* can have long folds (that are neither pores nor gills) or indeed be almost smooth.

The species of the lobe or fan-like *Arrhenia* genus have very varied sporing surfaces. One has normal gills, others have folding or veining that is more or less radiating and may be anastomosing (ie linking up and hinting at a pore-like condition). Sometimes again, all attempt at a raised structure is abandoned and the hymenium is smooth..

These alternative arrangements are not restricted to brackets, crusts, lobes and horns.

*Cantharellus tubaeformis* has a cap and stipe much like a conventional agaric and the Chanterelle, *C. cibarius,* even more so. Yet the fruiting structure, the hymenium, is blunt-edged and fold-like, with marked interveining.

Conventional agarics, such as some of the *Hygrocybe* species (eg *H. colemanniana*), are so interveined as to be verging on pore-like. Similarly, *Phylloporus pelletier*i is a bolete with gills, but very strong interveining. *Russula heterophylla* typically has anastomising irregular gills near the stipe, as does *Lactarius acerrimus*.

Among the smaller *Marasmius* and *Mycena* occurring on fallen leaves, minimal, or absent gills or veins can occur, such as in *Marasmius epiphyllus, Mycena polyadelpha* and *Mycena smithiana*. *Campanella caesia,* which grows on dead stems in the heart of large old clumps of Marram, *Ammophila arenaria,* can have a delightful, if somewhat irregular set of gills but may, especially if very small, have just one or two, or none. In these cases, the smooth underside of the cap is presumably fertile.

To make life yet more interesting, ascos such as *Peckiella lateritia* parasitise some *Russula* and *Lactarius* species, causing the unfortunate host to harden. Ridges and folds are formed as they colonise the gills, mimicking in so doing the rumpled hymenium of some basidiomycetes.

***Plicatura crispa - showing irregular folds***

***Craterellus sinuosus - showing elongated folding***

***Cantharellus cibarius - an agaric with gill-like folds***

***Hygrocybe colemanniana - showing pore-like interveining***

***Campanella caesia - showing reduced and irregular gills***

***Peckiella lateritia - an asco colonising a Lactarius sp.***

**……MORE GARDEN RUSTS AND FUNGI**

Debbie Evans

*Heuchera* Rust was first brought to my attention back in July, when a member of the local "Friends of Treborth Botanic Gardens" brought a sick *Heuchera* leaf to the laboratory for diagnosis and advice. Luckily, it was intercepted and given to me by my friend and potato blight expert, Dr. Dave Shaw, who thought it might be infected by a rust fungus. I was very excited as, it was indeed a rust called *Puccinia heucherae*, which is specific to this host and one that I had not previously seen. This was the first official record for North Wales - the only other reported Welsh record being from a Machynlleth garden centre in 2011, (pers. comm. Nigel Stringer). I visited the owner's riverside garden, where she grows several different varieties of *Heuchera,* but only the single plant of "Southern Comfort" was infected. This plant had been bought from a local nursery about 3 years ago and I suspect it was carrying the rust infection when purchased, rather than contracting it in situ, but has only now shown any symptoms.

*Puccinia heucherae*

*Gymnosporangium confusum "aecial horns"*

*P. heucherae* is a microcyclic rust[1] and produces small raised orange-brown to brown pustules (centre photo, above) - the telia containing the teliospores on the under-side of the leaves, with corresponding pox marks on the upper-side(lh photo, above). The infection can be quite heavy, causing leaves to die prematurely, as well as being unsightly. It needs to be dealt with promptly to avoid any weakening of the plant, or the spores infecting other ones, although Heucheras planted in a garden setting seem to be less likely to succumb than plants grown in containers, (pers. comm.). The advice for treatment[2] is to remove all leaves, including those not showing symptoms, without damaging the crown and to spray with a compound containing systhane like "Roseclear", with repeated sprays if needed.

*Puccinia heucherae* is a relatively new addition to the British rust list, only arriving in 2004 and probably originating from the USA on imported stock plants. The first official report was in 2006[3] and it has since spread via plant nurseries and garden centres. The wet weather this year may have suited the appearance of the fungus and further records are to be expected. I have visited several local outlets (**undercover**!!), both on the mainland and on Anglesey and, to date, have seen infected plants for sale at 4 places, all on different cultivars. These plants would have been bought in by the garden centres, rather than produced by them and the assumption might be that the plants are well looked after while in production.

The growers are now very aware of the rust problem and its affect on the saleability of their plants, so they are kept well-ventilated, watered, inspected and sprayed regularly, all to keep any rust in check. Once the plants enter the retail outlets they may not receive this amount of care and attention. Additionally, the breeding of *Heuchera* over recent years has resulted in a huge range of leaf colours and plants for every situation, but it may also have resulted in less robust plants, which are less able to withstand infection. The advice must be to always check plants carefully before purchase.

2012 appears to have suited the *Gymnosporangium* rusts, (pers. comm. NWFG) and this agrees with my own observations. I was recently working out at the Bangor University Farm and went to inspect a Medlar tree, *Mespilus germanica,* in the forest garden. I soon found a few leaves infected with *G. confusum.* This is visible as orange to reddish-orange spots on the upper-side of leaves and, initially, a similar area on the corresponding under-side. The latter later develops "aecial horns", small brown projections coming out from the leaf surface. This was the first record of the rust on this host for North Wales. Medlar trees are not commonly grown in private gardens, but the two other garden trees I have investigated have both had a few infected leaves – including the tree at Treborth Botanic Gardens.

*Gymnosporangium sabinae*

The University forest garden additionally yielded the first VC record of Pear Rust caused by *Gymnosporangium sabinae* - the symptoms are similar to those on Medlar with obvious bright-orange spots on the upper leaf surface. I recorded it on three different pear varieties and both young and old trees were infected. Since then I have also found the rust on trees in a couple of private gardens. While on my *Heuchera* Rust quest I took the opportunity to check the pear trees for sale at the garden centres and saw it at two outlets. This rust definitely appears to be becoming more common and widespread. For all my records I found only a few infected leaves and the effect on the trees would be minimal: but I have reports from outside my area of much heavier infections, resulting in early leaf drop. Both *G. sabinae* and *G. confusum* use *Juniperus sabina* as the other host to complete their life-cycle, but in most cases there was no Juniper present nearby, suggesting wind-borne infection, possibly over large distances. I would welcome hearing of other

people's experience of these three "garden rusts". I expect the latter is now very common in fruit growing areas such as Herefordshire.

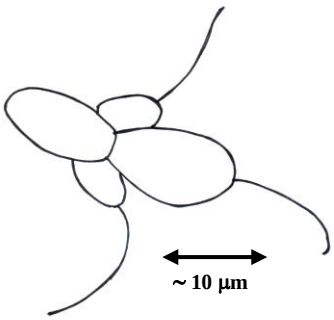
*G. confusum* can occasionally use Common Quince, *Cydonia oblonga*, as an aecial host and I was recently asked to check a tree which every year shows extensive dark spotting on the leaves and early leaf drop. The owner suspected this might be caused by a rust disease. On examining the lesions, I diagnosed instead Quince Leaf Blight caused by an Ascomycete fungus called *Diplocarpon mespili in its asexual, Entomosporium* conidial *state. Close examination of the leaf spots with a hand lens revealed numerous tiny black structures called acervuli, which are the fruiting bodies containing the conidia.* The complex hyaline macro-conidia, complete with appendages, that I found coming out of these acervuli were really amazing and different to anything I had seen previously. The disease can over-winter, explaining why it has been seen in successive years and is worse in wet seasons like this one. Apparently, it can affect Hawthorn, Pyracantha and Pear, but on these hosts it is only sporadic and causes a lot less damage.

Another "garden rust" that turned up for the first time this year was *Puccinia festucae* on Honeysuckle, *Lonicera periclymenum*. This is a heteroecious[4] rust, most often recorded as yellow-brown uredinia and brown telia on *Festuca* spp. of grass, although they are fairly inconspicuous. I found the aecial stage on honeysuckle cvs. in two gardens and on one wild plant. An infected leaf shows a typical yellow or orange spot on the upper surface with pretty fringed, orange aecial cups underneath. I have looked unsuccessfully for infected honeysuckle in previous years and began to wonder if I had been missing it? I discussed this with Nigel Stringer and he told me he has not seen the aecial stage himself, even on honeysuckle growing alongside infected *Festuca.* From our joint experience, this indicates that it must be fairly uncommon on the host, (or only very few leaves are infected), at least in Wales.

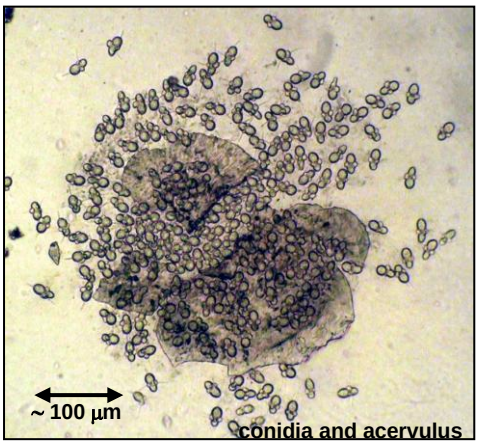
….And finally, another striking fungal infection was present in the forest garden. An Almond tree, *Prunus dulcis,* was again showing the colourful signs of Peach Leaf Curl caused by a galling fungus called *Taphrina deformans*. This as its name suggests is more commonly seen on Peach trees, but also occurs on Almond. The leaves can appear severely distorted and may be thickened and bright red in colour and diseased leaves usually fall off early. Another species of *Taphrina*, *T. pruni,* causes "Pocket Plums" on Blackthorn and some other *Prunus* species [see also HFSG News Sheet No. 4, Autumn 2002, page 4 – Ed.]. It causes a galling of the young fruit to form an elongated bladder-like structure and Jo Weightman commented back in June that it was very common this year in Kent - probably a reflection of the wet spring weather. I have not noticed much infection in NW Wales, but the Peach Leaf Curl was certainly very colourful!

[1]Only telia containing teliospores are found
[4] Uses 2 host species to complete the life-cycle

References:
[2]www.heucheraholics.co.uk, www.plantagogo.com
[3]Henricot B., Denton G., Lane C. First report of *Puccinia heucherae* on *Heuchera* spp. in the UK. *BSPP New Disease Reports* (2006) **13**, 38, *Plant Pathology* (2007) **56**, 352



Macro-conidium – drawing by D. Evans




***Above: Diplocarpon mespili in its Entomosporium* state**


***Puccinia festucae* aecial cups on Honeysuckle**


***Taphrina deformans* causing Peach Leaf Curl**

## JEKYLL-AND-HYDE KILLERS

Ted Blackwell

Prompted by the happy co-incidence of two inquiries, the Editor suggested I write this account. Initially, a query was raised about a mould. We are familiar with moulds on old cheese, or bits of damp wood, or damp shoe-leather. But the mould in question is more specific, in being very selective in what it 'eats'. It is found on insects and lepidoptera pupae. By coincidence, a striking photograph of this type of mould on a Ground Beetle was received from John Bingham.


There is a large category of fungi previously known as the 'Imperfect Fungi'. They were so called because at the time when first described they seemed to reproduce without a sexual process (i.e. without nuclear fusion and meiosis). In these fungi the disseminating 'spores' (asexual reproductive cells) are usually called conidia. The fungi themselves, after being known by a variety of names, in modern practice are appropriately referred to as **conidial fungi**.

As research has advanced, many conidial fungi have been discovered to have another form and structure, a 'perfect' state, known as the **teleomorph**, which reproduces by sexual spores. These two distinct states of the same fungus are usually very different in appearance and structure. Often, before the link between the different states of the same fungus was recognised, they had been described under different fungus names and were regarded as quite different species. An example is the common Coral-spot fungus, frequently found on decaying sticks where sometimes both states can be seen side-by-side. The perfect spore-bearing fruitbodies appear like miniature raspberries and are named *Nectria cinnabarina*, while the imperfect conidia-bearing fruitbodies appear as minute pink pustules known as *Tubercularia vulgaris*.


*Nectria cinnabarina (both states)*

Now the insect mould in question differs from Coral-spot in one important way: it does not start its career growing on dead material. It infects a live insect, which is then doomed to expire from the lethal infection. Fungi of this disposition are known as **entomopathogenic** (or **entomogenous**) fungi, interesting details of which can be found in a fascinating book, recently published.[1] Field mycologists may recognise such moulds by the spore-bearing structures which eventually sprout from insect corpses or mummified pupae.

Although some arthropod infections may be due to ingestion of conidia and infection is via the gut, it is believed that in the majority of arthropod fungal infections the fungus penetrates the insect's hard chitinous 'outer casing' (the exoskeleton). It does this by secreting chitin-degrading enzymes. It is interesting that fungal hyphal walls are also mainly composed of chitin, so somehow the fungus manages to avoid dissolving itself. After penetration, mycelium grows inside and feeds on the innards. It proliferates within the insect's body, killing it and replacing the internal organs with a mass of fungus tissue forming a sclerotium. In due course its fruiting conidia-bearing structures burst-out through less-resistant parts of the insect's 'casing'.

For many years this insect mould has been known by the name *Paecilomyces farinosus*. The question posed was: as *Paecilomyces farinosus* is a conidial fungus, did it have a perfect teleomorph state, and could that be the well-known Caterpillar Fungus, *Cordyceps militaris*? As both attack insects in a similar way, it seemed a reasonable speculation.
However, the first hint this may not be so was detected in a paper by R.E. Evans.[2] Evans describes an experiment of deliberately infecting an Eyed Hawk-moth pupa with *Cordyceps militaris* spores:

> "After some time there were signs of a whitish sclerotium beneath the chitin of the wing cases, followed by an extrusion of orange-pink processes at various points. These emerged at the folds in the pupa where the moth would normally break through. Earlier stages were rather similar to *Paecilomyces farinosus,* but more colourful and these developed into normal *Cordyceps militaris* sporophores. ..... It is not difficult therefore to understand how *P. farinosus* was first assumed to be a conidial stage of *Cordyceps militaris*." *[my underlining]*

*So in effect, Evans was saying this assumption was not correct.*

So the name *Paecilomyces* invited further investigation, from which it became apparent that the genus of its perfect teleomorph state refers to fungi of rather different habit from insect moulds. It is the Ascomycete genus *Byssochlamys* in the Order Eurotiales. One species, *B. fulva,* is implicated in the spoilage of canned and bottled fruit. "…the mature ascospores can withstand a temperature which is lethal to the spores of most fungi, and sometimes survive the sterilizing process" (Smith. *Industrial Mycology.* 1969). Another species, *B. nivea,* is found on rotting vegetation.

Significantly, before about 1965, the insect mould in question had been known as *Isaria farinosa,* but from about that time the 'current name' in the literature tended to be *Paecilomyces farinosus.* However in recent years much taxonomic re-sorting is taking place as a result of new techniques in DNA profiling, and from internet information and FRDBI, it is evident that *Isaria farinosa* has more recently become the 'current name'. Whatever the previous classification, currently *Paecilomyces* is placed in the Trichocomaceae – Eurotiales - Eurotiomycetes, whereas *Isaria* is placed in Cordycipitaceae – Hypocreales - Sordariomycetes (both are in Ascomycota). So our mould in question has returned to the genus in which, in 1832, Elias Fries placed it - without the benefit of DNA profiling!

After researching the internet it was found that the perfect (teleomorph) state of *Isaria farinosa* is *Cordyceps memorabilis, described as very uncommon.* The report of this discovery was by Pacioni & Frizzi, in *Canadian Journal of Botany* 56, 391-394, 1978.

So, to answer the query:

I. *Paecilomyces farinosus* has returned to being *Isaria farinosa, which*
II. does have a *Cordyceps* teleomorph - but the species is *Cordyceps memorabilis* rather than *Cordyceps militaris*.

The timely arrival of John Bingham's striking photograph raised the question of whether this was also *Isaria farinosa*. The victim here is a Ground Beetle (Carabidae) and, as certain entomopathogenic fungi are thought to be host-specific, a check was made in a specialist paper [3] under Carabidae. Interestingly, only *Cordyceps memorabilis* was listed. Looking further at FRDBI, the only fungus listed as occurring on Carabidae is ***Cordyceps entomorrhiza*** (in the anamorphic state of *Hirsutella eleutheratorum*). Turning to the *Ascomycete Checklist* for confirmation, while this species was listed, it was only 'on beetles', without stating which beetle genus or species.

Unfortunately, the specimen was not available for sending to the Royal Botanic Gardens, Kew for a proper expert opinion, as clearly there is more than one possibility. So John's picture is likely to be the anamorphic state of a species of *Cordyceps*, for which *Isaria farinosa* is a strong possibility.

In Britain, among a number of other *Cordyceps* species, some have anamorphs that are conidial entomopathogenic fungi:

| ***Teleomorph*** | **on** | **Anamorph** |
|---|---|---|
| *C. militaris* | *Lepidoptera larvae and pupae.* | *Cephalosporium militare* |
| *C. clavulata* | *scale insects* | *Hirsutella lecaniicola* |
| *C. forquignonii* | flies | *Hymenostilbe muscaria* |
| *C. gracilis* | *Lepidoptera larvae* | *Isaria dubia or Paraisaria dubi* |
| *C. sphecocephala* | *ants, bees and wasps* | *Hymenostilbe sphecophila* |
| *C. tuberculata* | *Lepidoptera* | *Akanthomyces sphingum* |

*As if to confuse the issue, certain British Cordyceps species are similarly parasitic, but infect and grow on, not insects, but the False Truffles, Elaphomyces. These are C. candensis, C. capitata and C. ophioglossoides - and the latter has a Verticillium anamorph. Perhaps in due course DNA analysis may indicate that those parasitising Elaphomyces belong to a different genus.*

Some entomopathogenic fungi have evolved remarkable – even bizarre – strategies for dispersal of spores and conidia. *Cordyceps* species characteristically develop long stalks to raise the fertile head above the soil (e.g. *C. militaris*), or into more turbulent air currents. Some fungi, such as the fly-cholera, *Entomophthora muscae*, induce flies to climb plant-stems towards the light to enhance dispersal, and dead infected flies can sometimes be found clinging to the tops of grasses near to stink-horns. When one hapless species of cicada becomes infected with another mould species, (*Massospora*) it invades the abdomen, but converts only part of its innards to powdery conidia. As the disease progresses, the still-living cicada sheds successive segments of its abdomen while continuing to move about, thereby facilitating conidia dispersal.

In the hope of perhaps encouraging a fascinating new line of research for any field mycologist willing to try it, it may be worth repeating the author's concluding comments in the specialist paper referred to above (Leatherdale, 1970):

> *"There is an obvious need for much more observation of infected material. The numbers of records published or otherwise made known each year must represent a very small fraction indeed of the true occurrence of entomogenous fungi, and collaboration between entomologist and mycologist cannot fail to be fruitful"*

For a more detailed account of entomopathogenic fungi, see HFSG News Sheet No. 16, Autumn 2008, *FUNGI AND CREEPY-CRAWLIES, PART 1,* pp.11-13.

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[1] *From Another Kingdom, the Amazing World of Fungi.* (2010), by L. Boddy & M. Colmore, Eds.: Chapter 4. *Animal slayers, saviours and socialists*, by H.C. Evans and Lynne Body. pp. 68-78, etc.

[2] *Proceedings of the Birmingham Natural History Soc*. Vol: 21 No.1 pp33-36 1967. By R.E. Evans.

[3] ARTHROPOD HOSTS OF ENTOMOGENOUS FUNGI IN BRITAIN. Entomophaga 15 (4) 1970. 419-435. By D. Leatherdale.